Applicant:

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For:

SENSOR READOUT CIRCUIT

A sensor readout circuit which provides a frequency signal output, the 1 1. 2 readout circuit comprising: a phase detector circuit responsive to an output signal from a sensor and 3 an input signal to the sensor and configured to detect the phase difference between the 4 input signal and the output signal; and 5 a drive circuit responsive to the phase detector circuit and configured to 6 7 maintain a fixed phase difference between the input signal and the output signal. The sensor readout circuit of claim 1 in which the fixed phase difference 2. 1 between the input signal and the output signal is maintained at zero degrees by the drive 2 3 circuit. 3. The sensor readout circuit of claim 1 in which the fixed phase difference 1 between the input signal and the output signal is maintained at 90° by the drive circuit. 2 1 4. The sensor readout circuit of claim 1 in which the fixed phase difference between the input signal and the output signal is maintained at 180° by the drive circuit. 2 5. The sensor readout circuit of claim 1 in which the fixed phase difference 1

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between the input signal and the output signal is maintained at 270° by the drive circuit.

- 1 6. The sensor readout circuit of claim 1 in which the fixed phase difference 2 between the input signal and the output signal is maintained at a fixed phase difference 3 between 0° and 360° by the drive circuit. 1 7. The sensor readout circuit of claim 1 further including a phase delay 2 adjustment circuit responsive to the input signal and the phase detection circuit for 3 adjusting the phase difference between the input signal and the output signal. 8. The sensor readout circuit of claim 1 in which the output signal is a 1 2 sinusoidal voltage at a predetermined frequency. 9. The sensor readout circuit of claim 8 in which the predetermined 1 frequency is in the range of 10 MHz to 30 MHz. 1 10. The sensor readout circuit of claim 8 further including a voltage step 2 module configured to offset the input voltage by a predetermined amount to offset the 3 frequency and measure the corresponding phase detector circuit output change.
- 1 11. The sensor readout circuit of claim 10 in which input voltage is offset 90°.
- 1 12. The sensor readout circuit of claim 10 in which input voltage is offset 2 180°.

- 1 13. The sensor readout circuit of claim 10 in which input voltage is offset 2 270°.
- 1 14. The circuit of claim 9 in which the Q is calculated from the ratio of the offset of the voltage and the offset of the frequency.
- 1 15. The sensor readout circuit of claim 1 in which the sensor is a flexure plate 2 wave device.
- 1 16. The sensor readout circuit of claim 1 in which the sensor readout circuit 2 continuously outputs a frequency representing the resonance frequency of the sensor.

1	17. A sensor readout circuit which provides a frequency signal output, the	
2	readout circuit comprising:	
3	a phase detector circuit responsive to an output signal from a sensor and	
4	an input signal to the sensor and configured to detect the phase difference between the	
5	input signal and the output signal;	
6	a drive circuit responsive to the phase detector circuit and configured to	
7	maintain a fixed phase difference between the input signal and the output signal; and	
8	a phase delay adjustment circuit responsive to the input signal and	
9	the phase detection circuit for adjusting the phase difference.	

1	18.	A sensor readout circuit which provides a frequency signal output, the	
2	readout circuit comprising:		
3		a phase detector circuit responsive to an output signal from a sensor and	
4	an input signal to the sensor and configured to detect the phase difference between the		
5	input signal and the output signal; and		
6		a drive circuit responsive to the phase detector circuit and configured to	
7	maintain a fix	ed phase difference between the input signal and the output signal; and	
8		a voltage step module configured to offset the voltage by a predetermined	
9	amount to offset the frequency and measure the corresponding phase detector circuit		
10	output change	·.	
1	19.	The circuit of claim 18 in which the Q is calculated from the ratio of the	
2	offset of the v	oltage and the offset of the frequency.	

1	20.	A sensor readout circuit which provides a frequency signal output, the	
2	readout circuit comprising:		
3		a phase detector circuit responsive to an output signal from a sensor and	
4	an input signa	l to the sensor and configured to detect the phase difference between the	
5	input signal a	nd the output signal;	
6		a drive circuit responsive to the phase detector circuit and configured to	
7	maintain a fix	ed phase difference between the input signal and the output signal;	
8		a phase delay adjustment circuit responsive to the input signal and the	
9	phase detection	on circuit for adjusting the phase difference; and	
10		a voltage step module configured to offset the voltage by a predetermined	
1	amount to off	set the frequency and measure the corresponding phase detector circuit	
12	output change	> .	

1	21.	A sensor readout circuit which provides a frequency signal output, the
2	readout circui	t comprising:
3		a phase detector circuit responsive to an output signal from a flexure plate
4	wave device a	and an input signal to the flexure plate wave device and configured to detect
5	the phase diffe	erence between the input signal and the output signal; and
6		a drive circuit responsive to the phase detector circuit and configured to
7	maintain a fixed phase difference between the input signal and the output signal.	
1	22.	The sensor readout circuit of claim 21 in which the fixed phase difference
2	between the in	nput signal and the output signal is maintained at zero degrees by the drive
3	circuit.	
1	23.	The sensor readout circuit of claim 21 in which the fixed phase difference
2	between the in	aput signal and the output signal is maintained at 90° by the drive circuit.
1	24.	The sensor readout circuit of claim 21 in which the fixed phase difference
2	between the in	put signal and the output signal is maintained at 180° by the drive circuit.
1	25.	The sensor readout circuit of claim 21 in which the fixed phase difference
2	between the in	put signal and the output signal is maintained at 270° by the drive circuit.

- 1 26. The sensor readout circuit of claim 21 in which the fixed phase difference
- 2 between the input signal and the output signal is maintained at a fixed phase difference
- 3 between 0° and 360° by the drive circuit.
- 1 27. The sensor readout circuit of claim 21 further including a phase delay
- 2 adjustment circuit responsive to the input signal and the phase detection circuit for
- 3 adjusting the phase difference.
- 1 28. The sensor readout circuit of claim 21 in which the output signal is a
- 2 sinusoidal voltage at a predetermined frequency.
- 1 29. The circuit of claim 24 further including a voltage step module configured
- 2 to offset the voltage by a predetermined amount to offset the frequency and measure the
- 3 corresponding phase detector circuit output change.
- 1 30. The sensor readout circuit of claim 21 in which the sensor readout circuit
- 2 continuously outputs a frequency representing the resonance frequency of the flexure
- 3 plate wave device.

- 1 31. A method for determining the frequency signal output of a sensor, the
- 2 method comprising the steps of:
- detecting the phase difference between an output signal from a sensor and
- 4 an input signal to a sensor; and
- 5 maintaining a fixed phase difference between the input signal and the
- 6 output signal.

1	32.	A method for determining the frequency signal output of a sensor, the	
2	method comprising:		
3		detecting the phase difference between an output signal from a sensor and	
4	an input signal to a sensor;		
5		maintaining a fixed phase difference between the input signal and the	
6	output signal; and		
7		adjusting the phase difference between the input signal and the output	
8	signal to a predetermined fixed phase difference.		